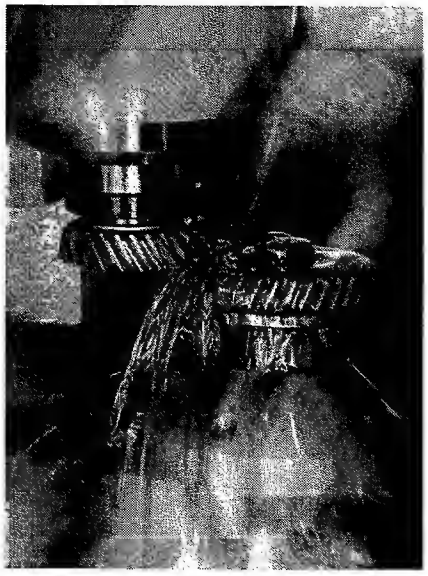
Gear Shaping Technology



John Lange
Gleason Product Mgr.
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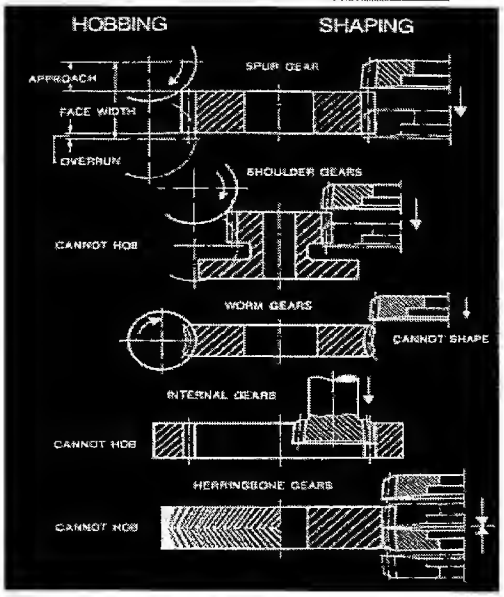
- Hobbing generally faster than shaping.
- Adjacent Shoulders and no clearance for hob
- Cluster gears- more than one gear in a setup, hold timing between gears
- Worm Gears – Not!
- Internal Gears
- Sector Gears
- Thick – Thin teeth
- Gap type, Block tooth
- Herringbone Gears with closed apex
- Narrow Face Width Gears < .25"



Gear Shaping Is A Generating Cutting Process

Shaping Versus Hobbing !

Profiles:

- In Hobbing the formation of the involute is limited to the number of enveloping cuts based on the number of gashes in the hob.
- **"Superior" In Shaping:** The number of enveloping cuts is controlled by the stroking rate and rotary feed and is referred to as the number of strokes per pitch

Lead:

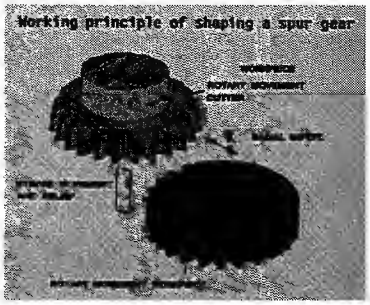
- In Hobbing the lead will have a surface finish affected by the axial feed rate and hob dia. (feed scallop depth) and typically considered rougher than with shaping. Also, on helical gears the feed scallop will be at an angle to the involute profile.
- **"Superior" In shaping:** With the shaping process the line of cut is along the entire tooth surface length resulting in a more uniform finish. The cut is along the line of action when shaping a helical but the number of strokes, enveloping cuts, is controllable based on the rotary feed and number of strokes per tooth.
- A major **negative aspect of shaping** has always been the need to have a helical guide if you are cutting a helical gear. This expensive and constraining tooling issue has been eliminated with the CNC Electronic Guide Feature!

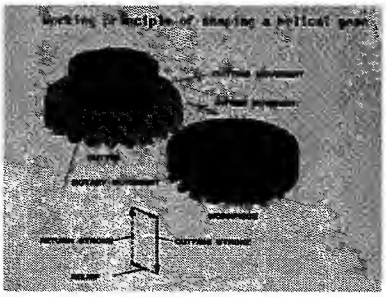
Pitch and Runout:

- **Superior In Hobbing:** In hobbing the generating process is a continuous indexing cutting action resulting in better pitch results. Also runout of the hob does not contribute to runout in the part.
- In the shaping process runout of the cutting tool contributes directly to runout in the part and potentially pitch error. Also pitch error in the manufacturing of the cutting tool can be "copied" into the part.

Working Principle of Shaping a Spur Gear:

- Radial Infeed
- Rotary Feed
- Stroking of the cutter
- Cutter spindle back-off

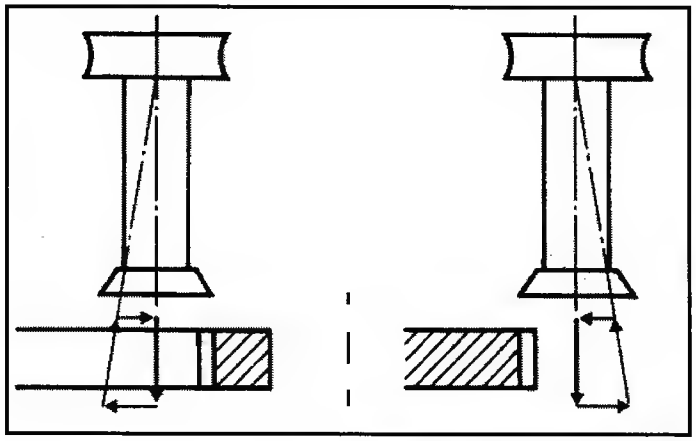




Working Principle of Shaping a Helical Gear:

- additional twist of the cutter spindle

"Modern" Spindle Relief Type Gear Shaper, Adjustment of relief (back-off) Amount and Change of Relief Direction



Large Internal Gears

External and Smaller Internal Gears
The Cutter Spindle Travels Across The Centerline Of The Part and Shapes On The "Far Side"

Mechanical Link between Cutter and Worktable on a Mechanical Gear Shaper (note index change gears)

Mechanical link and adjustment for stroke positioning of the cutter spindle

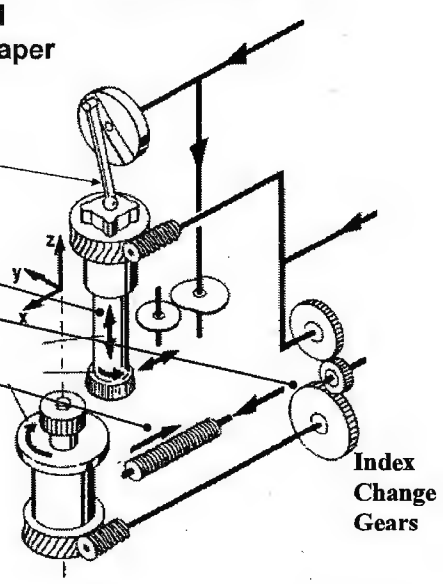
3 Separate Motors:

Main Motor Stroke Drive

Drive Motor Rotary Feed

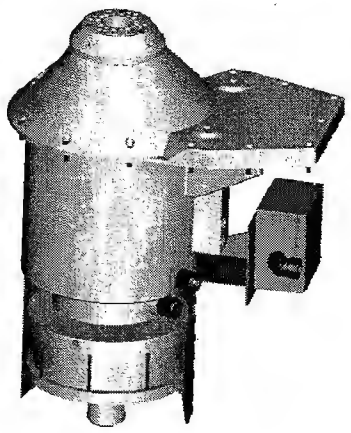
Drive Motor Radial Feed

Rotary feed and required rotational timing of workpiece and cutter are handled by index change gear drive train



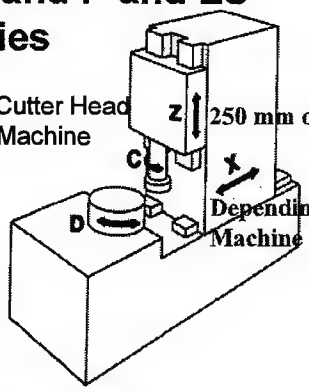
Modular Worktables (application dependent)

- **Direct drive worktable**
- **300 RPM (coolant spin off)**



GP and P and ES Series

Axial Cutter Head Slide Machine

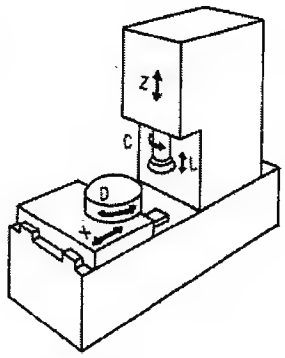


250 mm or Larger

Depending on Machine Model

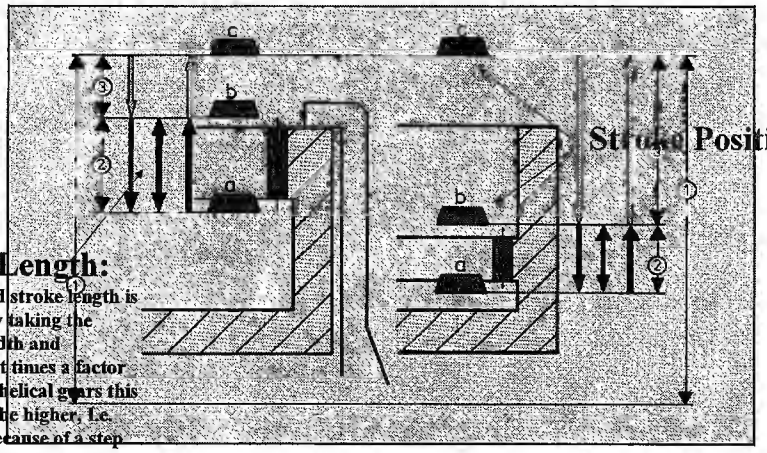
Cutter Head Slide CNC Shaper

Conventional CNC Shaper



Conventional CNC Shaper

The Importance Of Stroke Positioning!



Stroke Length:

The standard stroke length is calculated by taking the gears facewidth and multiplying it times a factor of 1.15. For helical gears this factor could be higher, i.e. maybe 1.2 because of a step sharpened face of the cutter.